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THE STUDY OF NATURAL HISTORY AS AN EDUCATIONAL DISCIPLINE.

BY J. ARTHUR THOMSON.

(Continued from page 339.)

So far as I know I have three main maxims, which it is needless to say I do not always observe. They may be expressed in the three words, *objective, Socratic* and *vital*.

(1) *Objective.* Let there in the name of education be something to *see*, an intact living thing, best of all; a specimen; a bit of a specimen; a picture; a diagram; anything—but let there be something to show and to see.

One remembers the legend of the botanical teacher who embraced the nettle in his first excursion, and was thus impressed with the distinction between theory and practice. And it is very common to find a student describing a beast or plant most carefully, and yet failing to recognise it when shown to him. Professor Lloyd Morgan tells of the child educated on picture-books only, where size-relations are rarely observed, who identified a shrew with its snout as a tapir. All this memory-science, all this cerebrating only in presence of print, all this getting up things instead of seeing them is a curse.

(2) *Socratic.* It is certainly a mistake to tell children too much. Let them have the joy of discovering things for themselves. There is a medium between merely baffling them and making them parrots. Often they may puzzle you more by their answers than you them by your questions; and in a dignified way let them feel that questions asked by them are of great value. In short, don't treat them as Strasburg geese: they are not that.

(3) *Vital.* By this word I mean that in the teaching of Natural History there should always be an atmosphere of livingness. The specimen, the picture, the diagram, must be made as far as possible instinct with life, with life similar to ours, as far as it goes.

According to the legend, a lady brought the great botanist a flower and asked him to name it for her. He said that he did not know it, but he would press it, and sit upon it for a few hours, and then, perhaps, it would be recognisable! Of course this is a libel; but it may serve to adorn the moral that Natural History is pre-eminently a study of *living* things.

The word vitality which I have used may also indicate that not only must the subject under attention be or become, as far as possible, living, but the treatment of it must be sympathetically vital.

If the teacher of botany does not feel that the plant is a living creature—growing, feeding, breathing, digesting, moving, feeling, struggling—then he has missed the gist of his business. The teacher, whether parent or school-teacher, has the difficult task of holding the balance between precision and accuracy on the one hand, and giving due encouragement to activity and originality on the other hand. Of course the teacher's own statements should be as clear and accurate as possible; if he or she cannot get clear about a question, then it is not for children: to give a false simplicity to facts is an educational sin, to teach what must be afterwards unlearned is another. Yet to avoid these sins is extraordinarily difficult; for instance, in speaking of the mental side of animal activities. It is most desirable to make every animal in its way like a little "Brer Rabbit," and not like an automatic machine; but one may with the best intentions carry this to an extreme of falseness. At the same time, though the teacher must stand firm on the foundation of accuracy, he must not expect too much of the children. There must be continual compromise, else he will discourage initiative and choke originality. He must wink at some mistakes as natural to the child's way of looking at things; and try to make up for it by insisting on precision at a more appropriate time.

There is an old story of a student who brought to Cuvier a new discovery in human anatomy. The prince of anatomists smiled, asked the student if he had ever dissected an insect, and on receiving an answer in the negative, bade him good-morning. But the student was wise as well as the master; he dissected the insect, returned to his discovery a wiser man, and found out something after all. I remember, too, with gratitude how Professor Geddes some ten years ago set me a botanical problem—still unsolved—at which I worked through a summer session and got almost no results, except the conviction that science is not an easy affair.

But while such snubbing is all very well for the adult student, it must be done very gently to the child. It *should* be done, of course, else education will be slipshod, but it should be done gently.

While these three words—objective, Socratic and vital—seem to me to sum up the chief virtues of the teacher of Natural History, there are other desirabilities.

(*a*) Big words, be they ever so comforting, are a snare. The seed-box of a plant is a simpler term than ovary, and, at least, as accurate; bony is better than osseous. When we find a medical student describing elephants as having "*deciduous* tails," we are warned to restraint when speaking to children.

(*b*) Again, it seems very desirable to keep the teaching in harmony with the march of the seasons. In spring we naturally think of buds and seedlings, tadpoles and lambs; not so naturally in mid-winter.

(*c*) We should avoid treating anything as common or unclean. Everything is wonderful. Remember Walt Whitman's lines:—

> "A leaf of grass is no less than the journey-work of the stars,
> And the pismire is equally perfect, and a grain of sand, and the egg of the wren,
> And the tree-toad is a *chef-d'œuvre* for the highest,
> And the running blackberry would adorn the parlours of heaven;
> And the narrowest hinge in my hand puts to scorn all machinery,
> And the cow crunching with depress'd head surpasses any statue,
> And a mouse is miracle enough to stagger sextillions of infidels."

It may be an exaggeration that the true botanist sees a tropical forest in every square foot of meadow, but Meredith is right:—

> "You of every well that springs,
> May unfold the heaven of things."

(*d*) A more common-place remark is this: Let the teacher ask himself how much he remembers of that course of chemistry or astronomy he attended a dozen years ago, and has since left undeveloped. The answer for most of us is, as far as particulars go, almost nothing. No small part of our pursuit of knowledge is an ingenious changing of one suite of brain-furniture for another—a process of gradual replacement. Let the teacher remember, then, that most of his pupils will soon forget almost all he has told them. What remains then? Not nothing; but some general ideas, a way of looking at things, some vivid incidents, a feeling for nature. This, I thinks, leads one to try on the one hand to effect occasional flashes and surprises which impress, and on the other hand to secure those general ideas which last.

I wish to answer a few objections against laying greater emphasis on Natural History in education.

I do not consider lack of time an objection, in the first place, because no great demand upon time need be made, and, in the second place, because the time-table is not a sacred thing, being merely an adjustment between three factors, all happily modifiable—(1) the number of minutes per day during which pupils can profitably interest themselves in various branches; (2) the demands of the parents; (3) the ideals of the teacher. The questions of time, space and expense are *difficulties*, but not objections.

The conservative objection, which may be exaggerated into obscurantism, is that only a smattering, a veneer, a pretence of science can be given in say forty lessons per annum. The medical student gets fifty. The truth underlying this has been tediously perpetuated in the proverb, "A little knowledge is a dangerous thing," to which I should add the postscript that rudimentary faculties and unopened doors—in short, an unnatural ignorance may be even more dangerous. The fallacy in the objection is that of forgetting the relativity of all education. We are not discussing the education of the botanist or zoologist—for him or her the programme is quite different—we are thinking of children most of whom will never be in any strict sense students of science. The amateur is not to be snubbed, except when he forgets his amateurishness; on the contrary, he is to be cultivated. Even if we happen to be specialists in something, we surely wish to be amateurs in many things.

The prejudice against amateurishness is partly due to an idiosyncrasy of human nature with which we are all familiar: it is this, that the more complex a subject is, the more ready are many to air their opinions about it. Psychology is just beginning to become an exact science; it is as much behind biology as biology is behind physics. Similarly, sociology is so incipient that many still deny that there is any such science. Yet a man who would never venture to be dogmatic as to an inference in physics will enter glibly into a theological argument in a railway carriage. Politics is a subject much more complex than biology, yet many are as confident in their political convictions as they are hesitating in their biological conclusions. Thus we find that educational, psychological, anthropological and other complex studies are just those in regard to which the amateur is fondest of taking exercise, mistaking his emotional convictions for intellectual ones, and rushing into speech or print with a dogmatism which disgusts and an impetuosity which amuses. But to condemn the amateur because of this human frailty is, if not unjust, certainly unprofitable.

Are we, in our recoil from "a veneer of culture," "a varnish of polite education," "an aping of science and scholarship," to fold our hands before a closed door? It is too absurd. Must we have an observatory to know something about the stars? Was not a new star surely as good as a new species, found by a man in this city with a shilling star-atlas and a half-guinea opera glass? As far as I can understand it, this objection to short courses, little books, amateur studies, and the hour-a-week of Natural History in schools is a relic of obscurantism, a dog-in-the-manger-ish selfishness, a superior bigotry of illumination, a non-educational desire to keep certain intellectual preserves safe from intrusion. It is the result of forgetting the truism that education is relative to given ends, the result of a misconception of what education should be for the average. Neither we nor our children wish to master the "Encyclopædia Britannica," we wish an increased power of *appreciation*, we wish keys to open doors, and as there are very many doors we do not wish to lock ourselves in behind any. Yet we are to forbear, lest we become superficial, or veneered, or varnished. It is too absurd! We know that we cannot appreciate all the accumulated treasures behind each door,—we never dreamed of such a thing; but we wish as much life and joy and usefulness as possible, and we decline to be shut out from any subject because the expert is afraid lest we forget that we are not altogether such a one as himself!

While refusing to believe that the fairy tales of science, or the treasures of poetic fancy, or the beauty of literary style, or the thoughts of the great thinkers in the past, should remain as the experts' pleasance, where all profane persons are roughly told to keep off the grass, we must recognise that we should know our Burns before Horace, our Shakespeare and Milton before Æschylus and Sophocles; and, further, that there are subjects of great difficulty which cannot be readily understanded either of the people or of children. To discuss the origin of variations before a popular audience would probably be unprofitable, unless one wished to effect a clearance. And there is much to be said for the plan of Tolstoi's peasant school, where the scholars were at liberty to decamp whenever their interest slackened. Yet surely it is a simple matter, though it may not be a popular method, to state clearly "This subject is very difficult, it is still under discussion by the experts, we had better leave it alone just now." While I believe that every truth is clear, I equally believe that almost everyone, whether child or adult, will respect the teacher and the science more if the confession be made that certain problems are not yet at that stage of truth which admits of clearness.

The objection which seems to me most important is this—Natural History is as yet for the most part in the position of being taken somewhat easily, more as a relaxation than as a serious subject. This is very insulting to Natural History, but it has this advantage—that in teaching children about plants and animals, one is, perhaps, freer and more spontaneous than if one were dealing with more routine subjects. The very word "subject" suggests a limitation, something cut and dried. Is it advisable, then, to press the question of education in Natural History, with the risk of its losing the charm which it usually possesses?

Grammar badly taught is a very dreadful thing, but it can hardly be said to have any far-reaching evil effects; but Natural History badly taught means spoiling the child's outlook upon nature.

From a teacher in an Edinburgh Board School, himself an Oxford graduate, I heard of the following object lesson on a sponge to one of the large—often far too large—junior classes. I quote the case with my apology to the actual teacher, and with my profound sympathy. A sponge was present, and that was well; for object lessons without objects are not unknown. It was shown dry, and then it was placed in water; that was not only well, but, as things go, excellent. The sponge swelled up, as sponges will do, and then the pupils were told that the sponge was ab-sor-bent. The word was written on the board; the pupils repeated, as they only can repeat, syllable by syllable—ab-sor-bent, ab-sor-bent. This was hideous. Next they were told that it was po-rous, po-rous. I believe they refrained from saying that it was spongy. But was there no hint, I said, of the interesting life of the creature? "Life of the sponge!" he said, in an amazed sort of way; and then we both laughed. The point is that instead of life-lore, the pupils were getting verbiage. I can quite well understand and condone it; but if this is the millstone which modern education is going to hang around the young life, then the less of Natural History in schools the better. But it cannot be so.

Perhaps I may give some more detailed illustration of two courses, one for children under 13 or so, another for children over 13.

For the juniors I should propose to keep close to common things, the frog before the crocodile; to teach mainly by objects and stories; to avoid too great directness or systematisation of instruction; to try to follow the seasons, though never so rigidly that the naturalness of this method is stiffened into a system; to avoid abstractions except by delicate suggestion; to refrain as much as possible from analysis, cutting up, or tearing to pieces; to keep the teaching close to life, *e.g.*, by reference to useful animals, domestic animals, animal products; and to try to get the children to help in collecting and the like.

Making and mastering a simple collection—a bookshelf museum, an aquarium, a garden if possible—will help in educating the habits of open eyedness, accuracy of vision, order and neatness. At each stage one should insist on *some* thoroughness and precision, else the teaching and learning both become slovenly; but not on too much, unless with picked pupils, else the pleasure becomes a task. Observation of some living animals—especially at work—*e.g.*, ants and bees, silkworms and birds, will help to foster

sympathetic interest in living creatures. Observation of some cases of growth, *e.g.*, seedlings, gnats, tadpoles, may serve to convey first conceptions of development.

Attention to a few common fossils may suggest the idea of history. Much should be made of very beautiful things, such as shells and feathers, yet never so as to suggest that any natural thing is ugly. A collection of horn, bone, ivory, skin, fur, feathers, carmine, coral, chalk, and so on is sure to be found interesting, and will stimulate the inquisitive impulse. For older pupils, there should be more extensive radius of observation, and a more intense study of the familiar. The common and often despised identification of plants is a most valuable exercise in precision, and it may readily rise to some practical and quite impedantic familiarity with the principles of classification. The constant use of a simple genealogical tree—so far as that is possible—of animals and plants will soon form itself into a mental photograph of a really valuable sort, though, of course, to the end of the chapter, some of the pupils will insist that bats are birds and whales fishes.

It is now time to study more precisely the functions of the animal body—which should be treated of gently at first. Here the teacher should repeat some of the beautifully simple experiments of animal and vegetable physiology. Some of these should, I think, be shown to quite young children; they are amusing and incite inquiry. It should surely go without saying that any experiment involving pain is absolutely mis-educational, though such have been indulged in in some American schools. At the same time there should be no excessive sentimentality, no blinking at obvious facts, no suggestion that the cabbage squeals when you pull it up. But nothing should be done to lessen reverence for life.

It is time too to see more deeply into the structure of animals and plants, to see into their insides, to compare the bird's skeleton with the cat's, to use the microscope a little. Here great care and delicacy seem to me necessary. The specimens should be beautifully clean, and it is easy to keep to things which do not make the child feel that an animal—a beautiful life—has been killed in order to show something. The seashore will supply most beautifully cleaned skeletons;

even the remnants of the dinner table may be scientifically transfigured. A larger museum should be made, with fossils beside the modern creatures. The aquaria should be extended; and in a boys' school there should always be a small collection of happy living animals most scrupulously attended to. In a town like this, there should be no difficulty in organising museum-walks and shore-walks. The children should help to mount specimens, everything imperfect being now rejected.

Throughout, the pupils should be induced to interrelate their different studies, to use their hand-skill in mounting specimens and making models, their drawing powers in making an illustrated catalogue, their geography in relation to the distribution of animals, their chemistry and physics in relation to physiology, their French and German to look up and spell out foreign books, their English style to write descriptions, and so on *ad infinitum*. Active function the means; all-round development the end; these are two of our educational ideals.

I should weary you beyond endurance if I went into further detail. I only meant to indicate that the days are past when the teacher even of Natural History could proceed in any happy-go-lucky fashion, relying upon his good intentions; even for parents that method or absence of method is becoming obsolete, as indeed the existence of this Union testifies. The educational programme must be thought out in relation to such psychological facts as we know.

The conclusion of my argument is that lessons in Natural History—which mean lessons in the beautiful, the marvellous, the dramatic; lessons as to growth and progress, as to industry and struggle, as to loving and living, will if taught by one who knows up to the limit of his or her teaching, and is unafraid to confess ignorance, who has a healthy reverence for both the known and the unknown, cannot but be an educational discipline of high value. But this value will be greatly enhanced when the teacher is one who has himself or herself, and can communicate to the pupils, a love, exceeding a simple love of things that glide in grasses and rubble of woody wreck.

THE INTELLECTUAL POSITION OF CHRISTIANS.

VIII.—THE RELATION OF THE SCRIPTURES TO THE CHRISTIAN REVELATION.

By E. M. Caillard.

It is not possible in an attempt to define and illustrate the intellectual position of Christians, to pass over in silence the subject proposed in the title of the present essay, for it is one which all must feel to be of special and peculiar importance.

In approaching its consideration we must be careful not to confuse the Christian Scriptures with the Christian Revelation. That has not been made in a *book*, but in a *life*, the life of Christ. The real subject of our enquiry is therefore the relation of the inspired writings to the life and person of Christ; and bearing this in mind, it will seem most appropriate to begin with the four Gospels, which contain the only records we have of that life.

Over the meaning of inspiration we need not linger. It has already been defined in Article V. as the enlarging and informing of existent faculties, "by a secondary operation of the same power by which they were first given and quickened." This being so, a human element must unquestionably enter into inspiration. The Divine message which has to be delivered must not only be couched in human language, but it must be grasped by human intelligence, and learned through human experience. In a word, it has to be spoken by men to men, and cannot therefore do other than bear marks of human limitation. It is here that such fatal mistakes have been made. Rightly apprehending that a Divine message must be Divinely safeguarded from human error, we have wrongly supposed, not that the safeguarding would consist in the Divine use of human limitations, but in the superseding of them altogether. Consequently the reproduction of the local colouring, the characteristic environment,